



Fuels for Fuel Cells

Pete Devlin

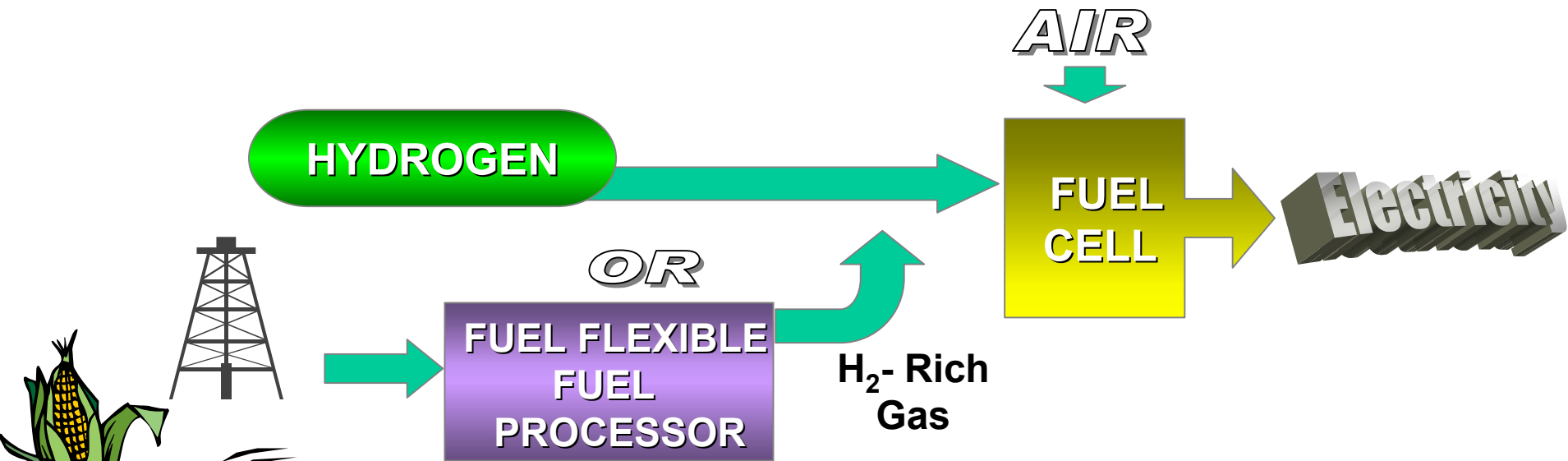
**Office of Energy Efficiency and Renewable Energy
U. S. Department of Energy**

**2002 Merit Review and Peer Evaluation
DOE Fuel Cells for Transportation R & D**

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DOE Transportation Fuel Cell Fuel Strategy

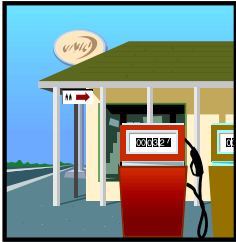


■ Hydrogen can be stored and supplied directly to the fuel cell: *Storage and Infrastructure Issues*

■ Hydrogen can be derived on-board from fuels such as ethanol, methanol, natural gas, gasoline or FT fuels: *Durability and Start-up Issues*



Hydrogen Infrastructure and Storage



Off-Board Reforming

- Purification
- Compression
- Dispensing



Renewables

- Wind
- Biomass



Pressurized Tanks

- Carbon Composites



Storage Materials

- Hydrides
- Carbon Nanotubes



Targets and Status

On-Board Hydrogen Storage Subsystem

Characteristic	Units	Target	2001 status Physical Storage	2001 status Chemical Storage
Storage capacity	Wt%	6	6	~3
Energy density	Wh/L	1100	800	1300
Cost	\$/kWh	5	50	18
Operating temperature	°C	-40 to +50	-40 to +50	+20 to +50



Targets and Status

Off-Board Hydrogen Production and Dispensing

Characteristic	Units	Current Status	2005	2010
Cost	\$/GJ H ₂	19.2	17.2	16.2
WTW GHGs	g/km	90	82	75
Primary Energy Efficiency	% (LHV)	62	68	75



On-board Fuel-Flexible Fuel Processor: Fuels Strategy

- R&D on APB fuels is the high technical risk. But, if successful, may enable early commercialization of light-duty FCVs.
- Testing of neat methanol and ethanol
 - Vehicle testing (experience/data)
 - ➔ lowers risk for production, warranty, safety issues
- On-board fuel processing of natural gas provides synergism with stationary and off-board fuel processing applications.

	DOE Fuel Processing Programs ¹		Vehicle Testing ²
	R&D	Testing	
Advanced Petroleum Based Fuel	+	+	
Methanol		+	+
Ethanol		+	
Natural Gas		+	

¹ Includes testing of blends

² California Fuel Cell Project